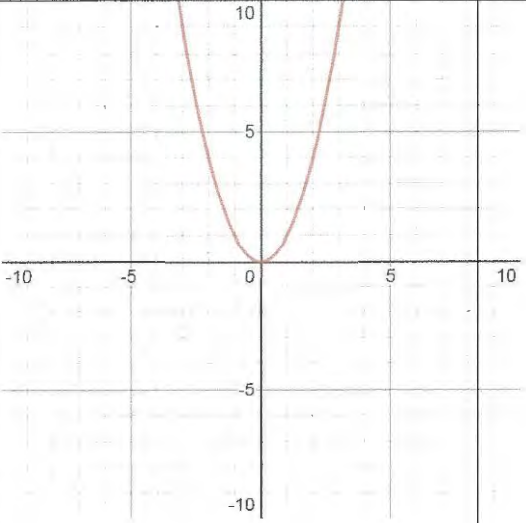
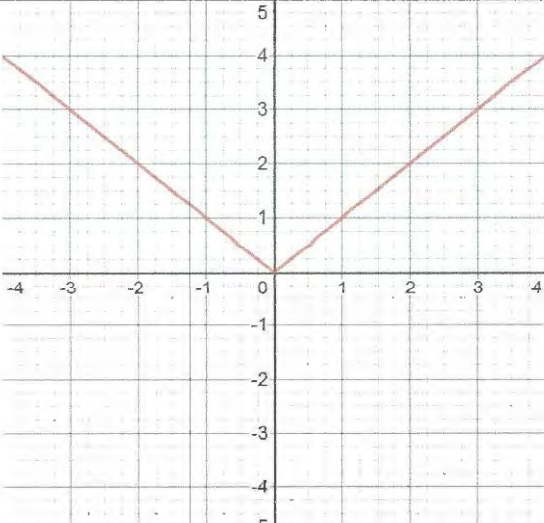


**Distance Learning: Transformations of Functions (Math 3 Section 1-2)**

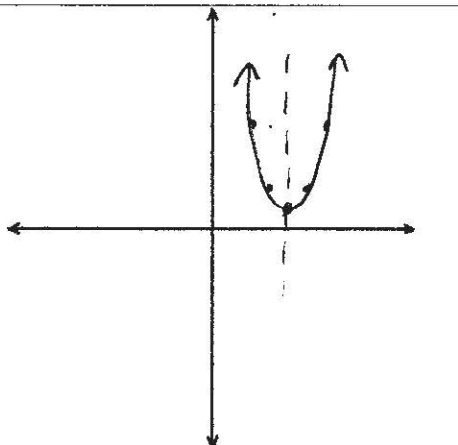
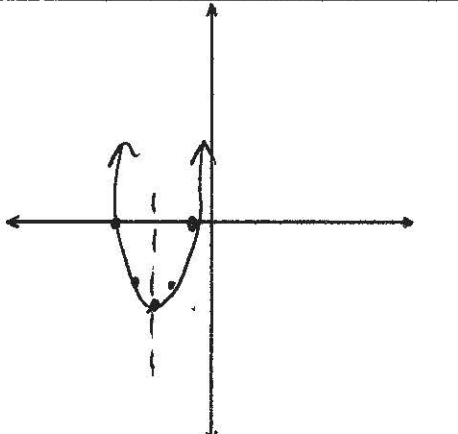
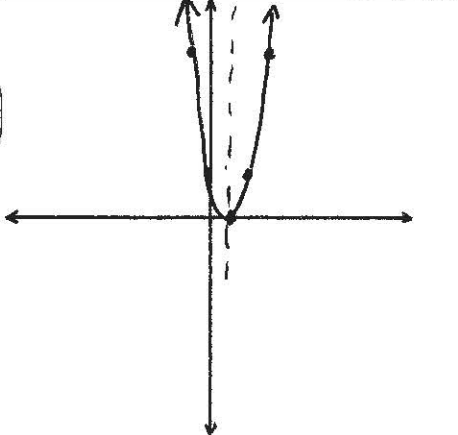
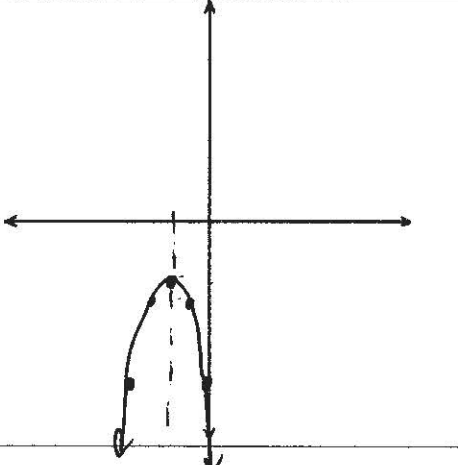
Remember these two parent functions and their graphs from Section 1-1:


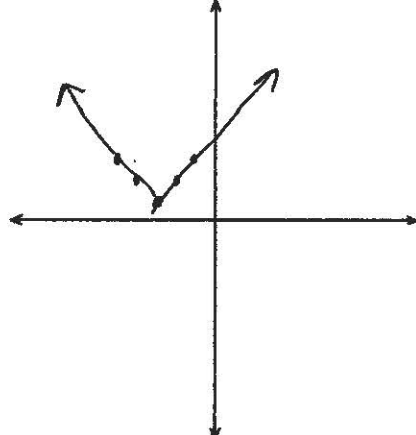

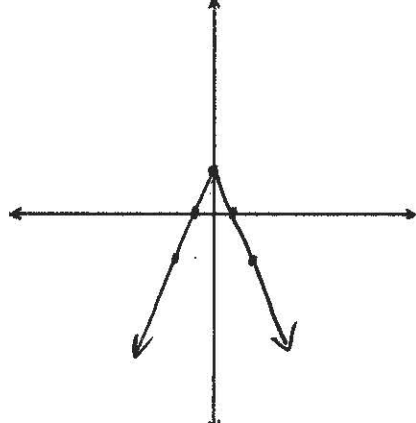
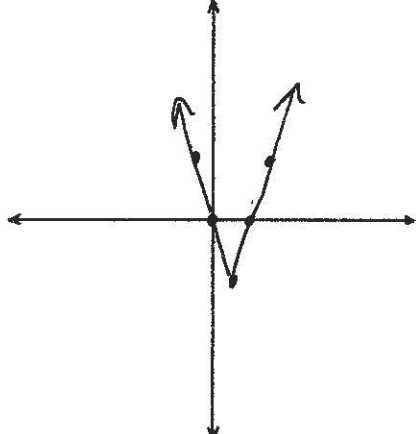
Quadratic: $f(x) = x^2$	Absolute Value: $f(x) =  x $
	
<p><b>Description:</b> Vertex at (0,0), Opens Up  <b>Shape:</b> Start at vertex, move <math>n</math> units right, move <math>n^2</math> up</p>	<p><b>Description:</b> Vertex at (0,0), Opens Up  <b>Slope:</b> <math>\pm 1</math></p>

**Transformations of the Parent Function Graphs**

1. When there is a number added or subtracted inside the function, that is a left/right translation (slide) in the opposite direction.
2. When there is a number added or subtracted outside the function, that is an up/down translation (slide) in the correct direction.
3. When there is a number multiplied by the function, the sign indicates which way it opens (up or down) and the number indicates a vertical stretch (if the number is greater than 1) or a vertical compression (if the number is less than 1).

Examples: Graph the following transformations of the two parent functions.

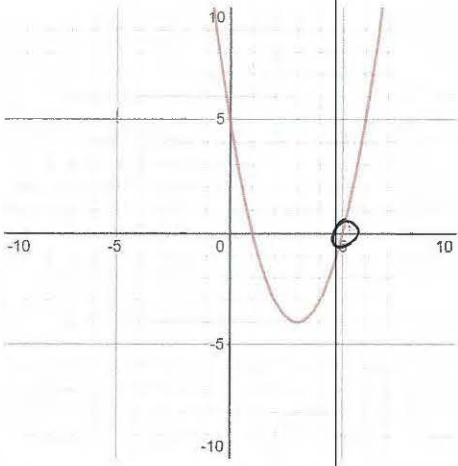
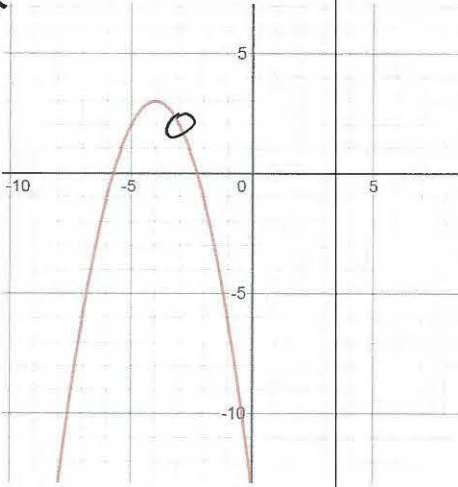
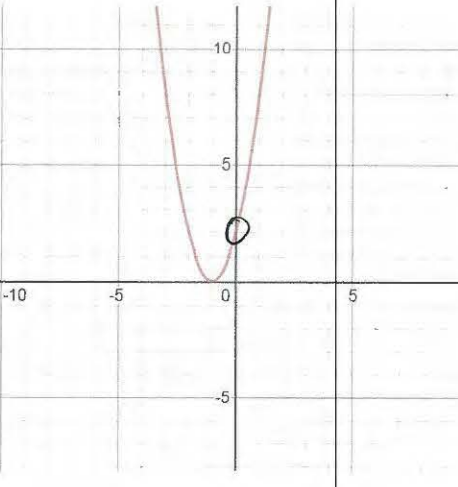
1	$y = (x - 4)^2 + 1$ <p>4R 1U Same shape as parent</p> <p>parabola</p>	
2	$y = (x + 3)^2 - 4$ <p>3L 4D Same shape as parent</p> <p>parabola</p>	
3	<p>*</p> $y = 2(x - 1)^2$ <p>1R Vert stretch x 2</p> <p>From vertex: move n right and <math>2(n^2)</math> up</p> <p>parabola</p>	
4	$y = -(x + 2)^2 - 3$ <p>2L 3D opens down Same shape as parent</p> <p>parabola</p>	

5		$y =  x + 3  + 1$  3L 1U "V" $M = \pm 1$ 	
6		$y = -2 x  + 2$  2U { opens down $M = \pm 2$ "V"	
7		$y = 3 x - 1  - 3$  1R 3D { opens up $M = \pm 3$ "V"	

**Vertex Form of the Parent Functions**

Quadratic Parent Function	Absolute Value Parent Function
$y = a(x - h)^2 + k$	$y = a x - h  + k$

Examples: Determine the Equation of Each Function Graphed Below

Number	Graph	Equation
1	 <p>vertex: <math>(h, k)</math> <math>(3, -4)</math></p> <p>point on graph <math>(5, 0)</math> (pick any point + plug in for <math>x</math> &amp; <math>y</math> to solve for <math>a</math>)</p>	$y = a(x-h)^2 + k$ $y = a(x-3)^2 - 4$ $0 = a(5-3)^2 - 4$ $0 = a(2)^2 - 4$ $0 = 4a - 4$ $4 = 4a$ $1 = a$ $y = 1(x-3)^2 - 4$
2	 <p>vertex: <math>(h, k)</math> <math>(-4, 3)</math></p> <p>point on graph <math>(-3, 2)</math> <math>x, y</math></p>	$y = a(x-h)^2 + k$ $2 = a(-3-(-4))^2 + 3$ $2 = a(1)^2 + 3$ $2 = a + 3$ $-1 = a$ $y = -(x+4)^2 + 3$
3	 <p>vertex: <math>(h, k)</math> <math>(-1, 0)</math></p> <p>point on graph: <math>(0, 2)</math> <math>x, y</math></p>	$y = a(x-h)^2 + k$ $2 = a(0-(-1))^2 + 0$ $2 = a(1)^2$ $2 = a$ $y = 2(x+1)^2$

4

Vertex:  $(h, k) = (5, -2)$

Point on graph:  $(7, 0)$   
x y

$$y = a|x-h| + k$$

$$0 = a|7-5| + -2$$

$$0 = a(2) - 2$$

$$0 = 2a - 2$$

$$2 = 2a$$

$$1 = a$$

$$y = 1|x-5| - 2$$

5

Vertex:  $(h, k) = (-1, 1)$

Point on Graph:  $(0, -2)$   
x y

$$y = a|x-h| + k$$

$$-2 = a|0-(-1)| + 1$$

$$-2 = a(1) + 1$$

$$-2 = a + 1$$

$$-3 = a$$

$$y = -3|x+1| + k$$

6

A parabola with:  
Vertex:  $(3, 7)$  and goes through the point  $(4, 10)$   
h k

$$y = 3(x-3)^2 + 7$$

$$y = a(x-h)^2 + k$$

$$10 = a(4-3)^2 + 7$$

$$10 = a(1) + 7$$

$$10 = a + 7$$

$$a = 3$$

7

A parabola with:  
Vertex:  $(-6, -5)$  and goes through the point  $(-4, -9)$   
h k

$$y = -1(x+6)^2 - 5$$

$$y = a(x-h)^2 + k$$

$$-9 = a(-4-(-6))^2 + -5$$

$$-9 = a(4) - 5$$

$$-4 = 4a$$

$$-1 = a$$

8

\* An absolute value function with:  
Vertex:  $(-5, 5)$  and goes through the point  $(-4, 3)$   
h k

$$y = -2|x+5| + 5$$

$$y = a|x-h| + k$$

$$3 = a|-4-(-5)| + 5$$

$$3 = a(1) + 5$$

$$-2 = a$$